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(54) LIGHT WEIGHT CHIP BOARDS AND A PROCESS FOR THE PRODUCTION THEREOF

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ABSTRACT

Light weight wood chip boards are made by incorporating a bonding agent in the amount of 16% to 20% by weight. Relatively low compressive force is used during the formation of the boards, which may also contain large amounts of sawdust. Process for producing such boards, wherein a light weight chip board characterized in that it also contains additives such as paraffins, asbestos fibers, borates or phosphates. Suitable bonding agents are urea/formaldehyde and phenol/formaldehyde resins hardened by addition of ammonium chloride. The bonding agents may also contain melamine or dicyandiamide.

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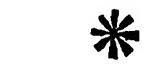
This invention relates to light weight wood chip boards made with amounts of a hardenable glue or bonding agent significantly greater than the amounts employed in prior art chip boards.

Chip wood boards, which are also known as chip boards, are basically produced by feeding natural wood through chipping machines, drying the resulting chips, adding a binding agent, rendering the chips into pressable chip cakes by means of a suitable spreading arrangement, and compressing the chip cakes to form chip boards using heat and pressure. It is thereby possible to produce boards having dimensions which are not to be found in natural woods and in addition to produce a material which has the advantage over natural wood of not changing or of only slightly changing its dimensions when subjected to different climatic conditions.

Various machines are available for gluing the chips, i.e., for applying the hardenable binding agent which usually consists of an aqueous solution of urea formaldehyde resin. Usually the urea formaldehyde resin is atomized in some way and the wood chips passed through this mist so as to be glued as regularly as possible. It stands to reason that the better the distribution of the glue on the chips the less glue which is required. Machine arrangements are also available which sift the chippings in some way and glue the coarse chips apart from the fine ones. This is advantageous as the fine parts generally attract the major part of the glue during a simultaneous gluing operation and additional glue has to be introduced so that the coarse chips also receive some binding agent.

Chip wood boards are produced in the form of single and triple layer boards depending on the spreading machine used to make them. The single layer boards have a compacted surface texture resulting from the concentration of smaller chips in this region while the triple layer boards have a middle layer of coarser chips, which is clearly defined from the outer layers consisting of smaller chips. Thus, in the case of both types of board there is a middle layer, which is merely more sharply or less markedly defined in relation to the surface areas, is homogenous in itself, and consists of coarse wood chips bonded together with glue.



A duroplastic binding agent, more particularly a urea formaldehyde resin together with a hardener such as ammonium chloride is used as glue. The choice of binding agent and hardener combination is not the subject of the invention and ammonium salts of other acids, peroxides, melamine, dicyandiamide, organic acids or other substances which crack acids at high temperatures can be used as hardeners with the urea formaldehyde resin.

The urea formaldehyde resins used can also be modified in any way to increase their elasticity or to reduce their wettability and belong to the aminoplasts in the broadest sense of the word.

Phenol resins have also acquired a practical significance in the production of chip boards. General acids and acid cracking substances, but also formaldehyde, hexamethylenetetramine and other substances capable of cracking formaldehyde, resorcin and peroxide are used as hardeners. These binding agent systems are known as phenoplasts. They can be used on their own or in combination with aminoplasts.

Other substances can be added in a known way to the mixture consisting of wood chips and binding agent which is present as an additive in the form of an aqueous solution. These substances may, for example, be a paraffin dispersion to render the board water repellant, and asbestos fibers, borates, phosphates or the like to reduce the flamability of the board.

The weight of chip boards is particularly important with respect to their use in the furniture industry. In the case of the known boards, the weight depends practically exclusively on the type of wood used for the chips as the degree of compression of the chips distributed in the heating press can only be varied within very narrow limits so that other important qualities such as the screwing resistance and the transverse stress strength do not suffer. It has been shown that under these circumstances only chip boards with a weight of, for example, 700 to 750 Kg/m^3, satisfactorily fulfill the requirements to which they are subject. At present, such boards can only be made out of hard wood chips, more particularly from beechwood chips and this raw material is not only relatively expensive but it is also increasingly difficult to obtain.

The present trend in machine production is to perfect a gluing

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system which makes it possible to use a minimum amount of binding agent to obtain maximum glue distribution.

It has now been found that the application of a substantially larger amount of binding agent produces materials, hitherto unknown in this form. If the binding agent portion, which is nowadays about 8% - the solid resin content of the binding agent relative to absolutely dry chips, is increased twofold and more, it is possible to produce so-called light chip boards. These are produced from the same chips and types of wood and yet weigh 85% of the boards produced by the known method and their characteristic factors are still within the commercial limits for chip boards of normal weight.

The subject of the present invention is thus a light chip wood board, consisting of wood chips compressed with a hardened glue substance, which is characterized in that the glue substance is present in an amount of 15 to 30% by weight and preferably 16 to 20%. It may also contain up to 60% by weight sawdust relative to the amount of wood as well as additives known in themselves such as paraffins, asbestos fibers, borates or phosphates.

In addition to the type of wood used, the quality of the wood chips, more particularly the fineness ratio, i.e., the ratio of chip length to chip thickness, is important for developing solidity. Chips with a high degree of fineness generally require a lesser amount of binding agent than chips with a low degree of fineness in order to obtain the same mechanical properties, more particularly the same bending strength.

In the process to produce the new light chip wood boards the appropriately selected wood chips are glued, dried to a residual moisture content of less than 15%, preferable less than 10% by weight and compacted to form a chip board. The process is characterized in that 15 to 30% and preferably 16 to 20% by weight hardenable glue relative to the dry matter is added to the wood chips and the degree of compression of the board is reduced as compared to the normal values.

However, it is not always possible to directly apply a desired amount of binding agent by the methods at present in common use in the chip board industry. If a larger amount of glue than is normally used according

to the state of the art is sprayed onto the chips the amount of water which finds its way into the chip material considerably complicates the production of chip boards which conform to the prescribed requirements and may even render this completely impossible. If the glued chips have more than 10 to 11% moisture on average the boards will either split when the heat press is opened as a result of the steam pressure which has developed inside or in order to avoid splitting, the pressing period will have to be considerably increased. However, both would render the production less economical. Furthermore, a high degree of moisture in the board causes breaks and buckling during cooling and storage.

To be sure of avoiding these disadvantages it is preferably to modify the process according to the invention. This may be achieved in the first instance by at least 15% by weight and preferably all the wood chips for processing being glued at least twice, if necessary with an intermediate storage period. In this process the chips are dried after the first gluing operation and after each subsequent gluing operation until the penultimate one until they contain each time a residual moisture content of 0.5 to 15% and preferably 1 to 4% (GIS 52 183). Any hardener which is to be added, depending on the glue used, is only introduced during the last gluing operation.

In the case of an important embodiment of the invention only a part of the total amount of wood chips are first glued and dried. These glued chips are then mixed with the remainder of the chips which have not yet been glued and this mixture is again glued before being supplied to the spreading machine.

The process can proceed generally as follows: a portion of the wood chips is glued and dried several times and the remainder of the wood chips are only added to the part of the chips which has been glued at least twice before the last gluing operation. In some circumstances it may be advantageous to introduce the wood chips in batches into the process when several gluing operations are being carried out. In this way a batch of the wood chips is added during each subsequent gluing operation.

Depending on the type of wood and binding agent used and for reasons of production it can be advantageous to store the glued wood chips before or

after drying them before continuing to process them. During this intermediate storage period the wood chips are stirred periodically and preferably constantly depending on the environmental conditions such as humidity and temperature as well as on the application of glue on the wood chips. During storage the relative humidity can fluctuate between about 40 to 95%. Although the temperature can fluctuate within very broad limits, i.e., between circa ~~-5~~ -5°C and +100°C, unless particular effects are to be obtained by especially low or especially high temperatures, the wood chips are stored at temperatures of ~~+10~~ +10°C to 40°C.

The portion of wood chips which has been glued several times should amount to 45 to 100%, preferably 60 to 100% by weight of the mixture prepared for processing on the spreading machine although in certain cases the process can be effected with an even lower percentage.

It was also found that it is possible to apply twice the amount or even more of a conventional binding agent to the wood chips using other methods than multiple gluing operations without incurring the previously mentioned disadvantages.

Thus it is possible, as has been discovered in the course of experiments, to glue the prepared wood chips in the conventional way using conventional resins and at the same time or subsequently to add urea formaldehyde resin in powder form. Simple mechanical devices can be used to mix the powdered glue with the partially or completely glued chips. For example, the glue may be introduced by means of a screw and the amount of glue is determined by the weight of the wood chips passing through. Care has to be taken when adding the powdered glue to ensure that it is in a finely distributed form to avoid the formation of lumps on the preglued wood chips.

Another variant for applying a quantity of glue according to the invention consists in that the wood chips to be glued are not dried initially in one of the conventional ways but that dry glue and/or liquid glue in an amount of 15 to 30% and preferably 16 to 20% solid resin calculated on the amount of absolutely dry wood material is added to the still wet wood chips. The glue must be add d in such a way as to ensur the finest and most uniform distribution of the powdered glue. In the course of the process according to

the invention it is advantageous for the chips to be stored for one or more hours after applying the powdered glue. The wet, glued chips are then subjected to one of the known drying processes and dried to the requisite temperature for the drying process. The amount of hardener required for hardening the glue in the heating process is then applied to the chips before they are introduced into the spreading machine.

Another way of applying to the wood chips double or even more than double the quantity of binding agent used according to a conventional method by the method according to the invention consists in that in contrast to processes according to the state of the art wherein the glue to be sprayed is more or less diluted in order to obtain the finest distribution possible and thus minimum glue consumption a high percentage solution of a binding agent containing ca. 65 to 80% solid resin is sprayed onto the chips. To obtain desirable viscosities for conventional spray nozzles of ca. 100 to 400 cP, the glue is sent through a preheater and heated to a temperature of from ~~35~~ 35°C to 95°C before being introduced into the nozzles. Generally it will be necessary to spray the requisite amount of hardener separately from the binding agent via suitable nozzles either onto the chips before gluing or onto the already glued chips. It can also be advantageous according to the invention to conduct the dry chips before entry into the nozzles or the glued chips after they leave the gluing mixer over a cooling area and to cool them to a temperature of from ~~20~~ 20°C to 30°C.

The examples described in the preceding part are only a few of the embodiments of the present invention. The object of all these is the application to the chips of quantities of binding agent containing 15 to 30% and preferably 16 to 20% solid resin, relative to the absolutely dry wood material, without the glued chip material according to the invention reaching the heat press containing a greater degree of moisture than that which is usual according to the state of the art and the production of light chipboards from this chip material. The physical properties of these boards should correspond to those of the standard weight boards produced by present conventional methods.

Only a few possibilities were described in connection with th pre-

viously mentioned embodiments without the framework of the present invention being restricted thereby. It is also possible to apply the binding agent according to the invention to the chips as follows: after preparation in conventional chipping machines the wet chips are glued with a portion of the binding agent provided in a pulverulent state. The chips are then subjected to a normal drying process and dried to a residual moisture content of 0.5 to 15%, preferably 1 to 4%. They are subsequently glued according to one of the standard embodiments in a conventional gluing mixer with a conventional quantity of 8 to 15% solid resin. In this case the requisite amount of hardener can be applied together with the glue mixture or separately via suitable nozzles. However, it is also possible to apply the glue consisting of 15 to 30% and preferably 16 to 20% solid resin, relative to absolutely dry wood, to the chip material in one operational step in the form of a conventional glue mixture together with the necessary hardener. The excess water is then removed in a protective drying process in which the glued chips are not heated to a temperature above 30 to 50°C. Alternatively, the entire amount of glue may be sprayed onto the chip material without the hardener additive. The glued chips may then be rendered down to the requisite moisture content by a drying process according to the state of the art and the hardener subsequently sprayed onto the glued chips before they are introduced into the spreading machine. A gluing operation may also be effected with a highly concentrated binding agent solution heated to a temperature of 50 to 95°C. During this operation only a part of the total amount of binding agent solution according to the invention is applied to the chips while the remaining part of the binding agent is distributed on the chips in powder form during or after the spraying of the highly concentrated solution. As has already been mentioned, it can be advantageous in all these cases to pass the chips through a suitable cooling area before introducing them into the spreading machine. Alternatively, the chips may be cooled after they leave the drier. It can also be advantageous, more particularly in the case of urea formaldehyde resins, to add a buffering substance such as ammonia, urea, melamine, dicyandiamide, etc. t the harden r solution so that the hardener should only take full effect

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in th heating press.

Although sawdust has already been added previously in the production of light chip boards in small quantities to the mixture to be pressed as an inexpensive filler it is novel in that in the cas of one embodiment of the process according to the invention extremely large amounts of up to 60% by weight of sawdust of the same or of another type of wood can be added to the wood chips to be introduced without the properties of the wood board being impaired.

On the other hand, it is also possible to largely remove the dust portions by sifting or by other devices and to produce light chip boards according to the invention which have only a small portion of dust or no dust at all.

Processes which are used to produce the light chip boards required by the furniture industry are known at present but these are based on fundamentally different considerations. Chip boards weighing 550 Kg/m^3 can be produced by the conventional process steps by using poplar exclusively. By using the method according to the invention a board can be produced having the same mechanical properties at a weight of 400 Kg/m^3 using the same raw material.

Another known method for producing light chip boards consists in keeping the chip material as dry as possible. The chips thus remain stiff and cannot be compressed as completely as damp material. After the press has been opened the chip cake springs back. As a result, chip boards are produced which weigh less than the same boards produced from wet chips. However, the disadvantage of the boards produced in this way is that their mechanical properties decrease in approximately linear relation to their weight and render them unsuitable for furniture construction.

The process steps described in the present invention for producing light chip boards have additional advantages. The choice of hardener and binding agent combination is not the subject of the invention and any desired ammonium salt, peroxide, melamine, dicyandiamide, organic acid or substance which splits acids when the temperature is raised may be used as a hardener

with urea formaldehyde resins. The urea formaldehyde resins used can also be modified in any way to increase their elasticity or to decrease their "wettability". They belong to the aminoplasts in the broadest sense. If a binding agent is used which has an aqueous urea formaldehyde solution, a pulverulent melamine resin along or mixed with melamine powder or with dicyandiamide in powder form may be added instead of the urea formaldehyde resin which is added in powder form. As a result, an extremely effective water repellant property is obtained and the glued areas are less sensitive to water and moisture and on the other hand the simultaneous addition of melamine or dicyandiamide powder can reduce the free formaldehyde content to such an extent that an odorless chip board is produced.

Other substances such as paraffin dispersions for repelling water and asbestos fibers, borates, phosphates etc. for reducing the flamability of the board can be added in a known way to the mixture consisting of wood chips and binding agent. These are in the form of an aqueous solution during the addition.

In the case of the procedural steps described according to the invention the binding agent can also consist of a liquid phenol formaldehyde resin. In the case of the pulverulent admixture of an excess of glue this phenol resin can also be combined with an urea resin powder, it being necessary to use a phenol resin which hardens in the acid region. Alternatively, melamine resin powder may be added to the chips glued with phenol resin. Other hardening or modifying means such as resorcin, hexamethylenetetramine, etc. may be used at this time.

The method according to the invention for applying large quantities of binding agent using highly concentrated solutions which are preheated to the desired spray viscosity in the gluding machine may also be applied to phenol resins. Conventional nozzles may be used but it is recommended that single substance nozzles are used to spray hot binding agents so that the liquid is not cooled by the inflow of air and the size of the drops is not increased.

The following examples will provide a more detailed description of

the present invention without representing any limitation of the same.

EXAMPLE 1

Beechwood chips having a 100% moisture content (GIS 52 183) are glued in a mixer with urea formaldehyde resin in a 50% aqueous solution, the formaldehyde content of the glued chips amounting to 10% estimated on absolutely dry wood. This corresponds to a solid resin content of ca. 22% by weight (22% FR/absolutely dry wood).

These chips are dried in a conventional dryer at a temperature of, for example, 160°C to a moisture content of 3%.

The glued and dried chips pass through the same or a second mixing device and are again glued with urea formaldehyde resin in a 50% aqueous solution, the solid resin content of the second application of glue being 8%, calculated on absolutely dry wood. At the same time a 20% aqueous ammonium chloride solution is introduced into the mixer either mixed with the glue solution or by means of a separate spray. The solid ammonium chloride in the added solution constitutes 2% of the entire solid resin present.

The chip mixture leaving the mixing machine can be examined by the ball test as to its suitability for processing on the spreading machine. To carry out this test a ball is formed by hand from a sample. The appearance of the ball and its tendency to disintegrate, which are parameters for the continued processing of the chip material, are examined visually.

The spreading machine or the speed of the passage of the sheet and the distance between the bars in the heating press are adjusted so that the chip board obtained is 19 mm thick after scraping or cutting and weighs 450 Kg/m^3. If all other characteristic factors are kept within the standard commercial limits the finished board will have outstanding screwing strength.

EXAMPLE 2

100 Kg pine chips having a 150% moisture content (GIS 52 183) are divided into two portions, part A) weighing 75 Kg and part B) 25 Kg. Part A) is mixed with 50 Kg sawdust having a 100% moisture content (GIS 52 183). This mixture is glued with urea formaldehyde resin in a 50% aqueous mixture, the solid resin content of the glued mixture amounting to 15%, calculated on

absolutely dry wood. The glued chips are dried in a flame dryer at a temperature of 700°C, the moisture content after drying amounting to 2%.

Part B) passes through the same or another dryer and produces chips with a 2% moisture content. The glued and non-glued dried chips are stored at a relative humidity of 55% and at a temperature of 18°C for 18 hours. During this time, they are turned constantly.

The chip mixture prepared in this way is glued in a mixer with a 50% urea formaldehyde solution, the solid resin content of this second application of glue amounting to 8%, calculated on absolutely dry wood. At the same time a 20% aqueous ammonium chloride solution is introduced into the mixer either mixed with the glue solution or sprayed separately. The amount added is such that the solid ammonium chloride amounts to 1.8% of the entire solid resin present.

The spreading machine or the speed of the passage of the sheet and the distance between the bars in the heating press are adjusted so that chip board which is obtained is 19 mm thick after scraping or cutting and weighs 500 Kg/m^3.

If all other characteristic factors are kept within the standard commercial limits the finished board will have excellent solidity for receiving screws.

EXAMPLE 3

Pinewood chips which had been processed in conventional chipping and sifting devices to form surface layer chips and after being passed through a flame dryer had been brought up to a moisture content of 4% were glued in a suitable mixer with a 50% solution of a urea formaldehyde resin. The solution was applied in such a manner that 10% solid resin was added to absolutely dry wood. After the chips had passed 2/3 of the way through the glue mixer 100 Kg urea formaldehyde dry glue per 1000 Kg dry chips corresponding to 10% solid resin based on absolutely dry chips were supplied to the mixer via a proportioning screw and the dry glue was distributed on the partially glued chips. The chips were then passed through the remaining 1/3 of the glue mixer. At the end of the mixer a 16.7% NH_4Cl solution was sprayed in, the solid NH_4Cl

constituting 2% of the entire solid resin applied. On leaving the glue mixer the chip mixture had a 12% moisture content which was suitable for the continued processing on the spreading machine.

A mixture consisting of 40% beechwood and 60% pinewood which had been processed in a suitable way to form middle layer chips and had been dried in a conventional dryer to a 2.5% moisture content was sprayed with a 53% solution of an urea formaldehyde resin containing 6% NH_4Cl, estimated on solid resin, in a separate gluing machine in such a way that 8% solid resin was applied to absolutely dry wood. As in the case of gluing the surface layer, urea formaldehyde dry glue was introduced into the last third of the gluing machine by means of a proportioning screw. The application was effected in such a way that 80 Kg dry glue were applied to 1000 Kg dry chips. Thus in all, the middle layer received 16% solid resin based on absolutely dry chips.

The middle layer chips produced in this way had a 7.5% moisture content and could be used directly in a conventional spreading machine. The glued surface and middle layer chips were now spread on spreading machines to form a chip cake composed of 30% surface layer and 70% middle layer. By appropriate adjustment of the spreading machines, of the speed of the passage of the sheet and the distance between the plates in the heating press, a 19 mm chip board weighing 480 Kg/m^3 was obtained after scraping or cutting. The pressing conditions corresponded to the normal values in the chip board industry.

The chip boards produced in this way possessed characteristic factors within the commercial limits but were distinguished in particular by an excellent solidity for receiving screws.

EXAMPLE 4

Surface layer chips, which were produced in a conventional manner and dried to a residual moisture content of 6% were glued with a 70% urea formaldehyde resin, the viscosity of which was 800 cP at 20°C. To obtain the requisite spray viscosity the glue was passed through a heat exchanger before entry into the spray nozzle and was heated to 55°C. The nozzles were single substance nozzles to ensure that the temperature of the glue was not lowered

too much. 22% solid resin estimated on absolutely dry chips was applied. After the entire amount of glue had been sprayed on, the hardener was sprayed on at the end of the gluing mixer in separate spray nozzles. The amount added was such that 1.9% NH_4Cl was added, calculated on solid resin. The glued chips prepared in this way had a 13% moisture content and were suitable for immediate use on the spreading machine.

Middle layer chips were likewise produced in a known way and dried to a residual moisture content of 2.5%. These chips were glued in a conventional gluing mixer having single substance nozzles with a 75% urea formaldehyde solution having a viscosity of 2800 cP at 20°C. 16% solid resin calculated on absolutely dry chips was applied. As the glue could not be sprayed on directly it was heated to 80°C on a heat exchanger before being introduced into the spraying nozzles. The chips were cooled to a temperature of 25°C before being supplied to the gluing mixer. Before the chips were discharged from the gluing mixer the hardener was injected in separate nozzles in the form of a 16.7% NH_4Cl solution. 2.7% NH_4Cl, calculated on solid resin, was added. On being discharged from the gluing mixer, the glued chips had a moisture content of 8%. They were perfectly suitable for immediate use in the spreading machine.

The glue coated surface and middle layer chips in the ratio of 30:70 were spread on conventional spreading machines to form a triple layer cake. During this process, the spreading machines, the speed of the passage of the metal sheet and the distance between the heating plates on the press were adjusted so that the chip board which was produced weighed 440 Kg/m^3 in the finished state and was 19 mm thick. The board was pressed under conditions standard to the chip board industry.

By suitably adjusting the chipping devices it was ensured that chips with an average thickness of 0.1 mm had a fineness ratio of ca. 100.

The chip board produced under these conditions had characteristic factors within the commercial limits but was distinguished in particular by good bending strength and surprisingly by its capacity for receiving screws.

EXAMPLE 5

The wood chips to be used were prepared in the respective chipping devices, sifters and dryers of a known plant for producing single lay r boards. The chips were then dried until they had a 3.5% residual moisture content. These chips were sprayed in a gluing mixer with a mixture consisting of 100 parts of a 50% phenol formaldehyde glue and 6.5 parts of a hardener suitable for this resin so that the solid resin portion calculated on absolutely dry wood, amounted to 8%. A melamine formaldehyde powdered glue was supplied to the partially glued chips in the last third of the gluing mixer by means of a suitable proportioning device, the rate of application being controlled in such a manner that 100 Kg powdered glue was applied to 1000 Kg dry chips, corresponding to 10% solid resin calculated on absolutely dry chips. The remainder of the phenol resin was sprayed on in the next part of the gluing mixer to that where the powdered glue was added. The chips which had thus been coated with 18% solid resin and had a 9.5% moisture content were directly supplied to the spreading machine to produce a single layer board. By a suitable choice of spreading conditions, a chip cake was produced which, by adhering to known pressing conditions resulted in a board weighing 520 Kg/m^3 and a thickness of 19 mm.

The board attained the previously described solidity values and was characterized by excellent swelling values.

EXAMPLE 6

The chip material prepared in the normal way for a single layer board and dried to a residual moisture content of 2% was sprayed with an acid hardening phenol resin in a gluing mixer. This phenol resin had a 65% solid resin content and a viscosity of ca. 3000 cP. As it could not be sprayed with sufficient fineness in its existing state it was heated in a heat exchanger to 55 to 60°C before being introduced into the nozzles, these nozzles again being single substance nozzles. The requisite hardener was sprayed on at the end of the gluing mixer by separate nozzles. The chips were glued with 18% solid resin in all. The amount of hardener added amounted to 8.5 parts hardener solution p r 100 parts liquid resin. The moistur content of th chips on leaving the gluing mixer was 9%. The glued chips could be processed

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immediately in the spreading machine. A single layer board was produced under known conditions. After the surface had been finished the board weighed 5.0 Kg/m^3 and was 19 mm thick. The characteristic factors of the chip board produced in this way were within the standard commercial limits.

EXAMPLE 7

Wood chips which, after passing through the chipping and sifting devices had been prepared in the normal way for the production of a single layer board and had a 100% wood moisture content, were mixed in a mixer with an urea formaldehyde powdered resin. 200 Kg dry glue per 2000 Kg wet chips was supplied to the mixer via a proportioning screw. The wet chips with the dry glue were then conveyed to a chip bin in which they were stored for 60 minutes while being turned constantly. The chips were then dried in a conventional dryer to a residual moisture content of ca. 9%. The dried, glued chips were passed through a cooling area after being dried and were brought to 29°C. They were then introduced into another mixer into which, on the one hand, a 33% paraffin emulsion in quantities of 5 Kg solid paraffin per 1000 Kg absolutely dry wood chips and on the other hand a 15% solution of ammonium chloride, which still contained 4% ammonia, were sprayed onto the chips by means of nozzles. The amount added was such that 2% ammonium chloride calculated on solid resin were sprayed onto the chips. These chips were suitable for immediate introduction into the spreading machine and had an 11% moisture content.

These chips were formed into a chip cake in a conventional spreading machine. By adjusting the spreading machine, the speed of the passage of the sheet and the distance between the heating plates of the press a chip board was produced which weighed 490 Kg/m^3 and which was 19 mm thick. The pressing conditions corresponded to the standard values in the chip board industry.

The chip boards produced under the conditions which have just been described had characteristic factors within the standard commercial limits and very good screw solidity.

EXAMPLE 8

Chip material which had been prepared in the normal way for the production of single layer boards and which possessed a residual moisture content of 4% was glued with a 70% urea formaldehyde resin in a suitable gluing mixer. The urea formaldehyde resin had a 1500 cP viscosity. The resin was heated to 50°C to obtain the necessary spray viscosity. 257 Kg of binding agent per 1000 Kg absolutely dry chips was sprayed on. As a result a coating of 18% solid resin on absolutely dry wood was obtained. 20 Kg melamine powdered resin per 1000 Kg absolutely dry wood was added by means of a proportioning screw in the last third of the gluing mixer. As a result the powdered resin was applied to the partially pre-glued chips and was able to adhere well. A 15% ammonium chloride solution was sprayed on at the end of the gluing mixer by means of special nozzles. The addition was such that the ammonium chloride content amounted to 2% relative to the amount of solid resin added. On being discharged from the gluing mixer the glue chips had a 10.5% moisture content and were introduced directly into the spreading machine. A 19 mm thick chipboard was produced under conditions according to the state of the art. After the surface of the board had been cut the board weighed 470 Kg/m^3. The characteristic factors of the board produced in this way were within the standard commercial limits.

EXAMPLE 9

Chip material for producing a single layer board was prepared in the normal way and dried to a 2% residual moisture content. These chips were sprayed with a 47% solution of a commercial phenol formaldehyde resin in a gluing mixer so that the chips had an 18% solid resin content relative to absolutely dry wood and a 16% moisture content on leaving the gluing mixer.

However, these chips were too moist to be introduced into a heating press and were thus dried to a residual moisture content of 10.5% in a conventional conveyor drying machine. After drying, 8.5 parts hardener solution per 100 parts liquid resin were sprayed onto the glued chips. As a result, the moisture content of the glued chips was 11.2% and the chips were suitable for immediate introduction into the spreading machine. A single layer board

was produced by a method according to the state of the art. After the surface had been cut the board weighed 500 Kg/m^3 and was 19 mm thick. The characteristic factors of the board were within the standard commercial limits.

As has already been stated, the above examples are intended to illustrate the process according to the invention without in any way limiting the scope of the same. Likewise, the individual process steps of the above Examples may be combined. For example, Example 4 or 6 may be combined with Example 7.

Surface layers and middle layers could also be produced according to different processes.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A light weight chip board consisting of wood chips which are pressed together with a hardened binding agent, characterized in that the binding agent is present in the amount of 15% to 30% by weight, based on the weight of absolutely dry wood chips present.

2. A light weight chip board according to claim 1, containing 16% to 20% of binding agent.

3. A light weight chip board according to claim 1, characterized in that it contains up to 60% sawdust relative to the amount of wood.

4. A light weight chip board according to claims 1 or 2, characterized in that it also contains additives such as paraffins, asbestos fibers, borates or phosphates.

5. A process for producing light weight chip boards according to claim 1, wherein wood chips are glued, dried to a residual moisture content of less than 15%, and subsequently compressed to form a chip board, wherein the amount of hardenable glue added to the wood chips is 15% to 30% relative to the dry material, and the degree of compression of the board is reduced with respect to standard compression values.

6. A process according to claim 5 wherein the residual moisture content is less than 10%.

7. A process according to claim 5 or 6 wherein the amount of hardenable glue is 16% to 20%.

8. A process according to claim 5, wherein at least 15% by weight of the wood chips to be processed are glued at least twice, if necessary with an intermediate storage period, the chips being dried to a residual moisture content of 0.5 to 15%, after the first and up to the penultimate gluing operation, and any hardener t be added being selected according t the glue

employed and being added during the last gluing operation.

9. A process according to claim 8 wherein all the wood chips to be processed are glued.

10. A process according to claim 8 wherein the residual moisture content is 1% to 4%.

11. A process according to claim 8 characterized in that the remainder of the wood chips are only added to the portion of the total amount before the last gluing operation.

12. A process according to claim 8 characterized in that the portion of wood chips subjected to a first gluing operation is mixed with the remainder of the wood chips after drying, and the mixture is subjected to a second gluing operation before being supplied to a spreading machine.

13. A process according to claim 8 or 11 characterized in that the storage period is dependent on the humidity and temperature, and the application of the binding agent on the chips.

14. A process according to claim 8 or 11 characterized in that 45 to 100% by weight of the chips in the mixture prepared for processing on the spreading machine have been glued a number of times.

15. A process according to claim 8 or 11 characterized in that the wood chips used contain up to 60% by weight of sawdust relative to their total weight.

16. A process for producing light weight chip boards according to claim 1 characterized in that the wood chips in a pre-dried or naturally moist state undergo at least one of the following process steps:

(a) spraying with a duroplast solution of a concentration containing 45% to 52% by weight solid resin until the solid resin content is 15% to 30% by weight relative to the dry wood chips, said chips being dried if necessary after spraying to a r sidual moisture content of less than 15% by

weight.

(b) spraying with a duroplast solution containing 65% to 75% by weight of solid resin, the viscosity of which is lowered to between about 100 and 400 cP by heating until the solid resin content is 15% to 30% by weight relative to the dry wood chips, said chips being dried if necessary after spraying to a residual moisture content of less than 15% by weight.

(c) the addition of 15% to 30% by weight of solid, unhardened, duroplast powder relative to the amount of wood chips, the necessary amount of hardener being sprayed onto the wood chips by means of suitable nozzles in steps (a), (b) and (c).

17. A process according to claim 16 wherein the residual moisture content is reduced to less than 10% by weight.

18. A process according to claim 12 characterized in that the hardener is sprayed onto the wood chips before or after the duroplast solution.

19. A process according to claim 8 characterized in that a buffer such as ammonia, urea, melamine or dicyandiamide is added to the hardener.

20. A process according to claim 12 characterized in that the wood chips are cooled to between 20°C to 30°C before gluing.

21. A process according to claim 12 characterized in that the wood chips are cooled to between 20°C to 30°C after gluing.

22. A process according to claim 12 characterized in that the wood chips are cooled to between 20°C to 30°C during gluing.

23. A process according to claim 16 characterized in that a duroplast solution and a duroplast powder containing the necessary amount of hardener are both used.

24. A process according to claim 16 characterized in that a urea formaldehyde resin solution is used as the duroplast solution and a urea formaldehyde resin powd r is used as the duroplast powder.

By

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REMPLACEMENT

SECTION is not Present

Cette Section est Absente